Claims

What is claimed is:

5   1.   A method for reconstructing a synthetic network, the method comprising the steps of:

determining, on a node-by-node basis, connections existing between nodes in the network by the steps of:

sequentially forcing an output of a node in the network to a value

10   of zero;

computing a similarity measure between the output of the node and an output of one or more other nodes in the network; and

placing one or more putative connections based on the similarity measure.

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2.   The method of claim 1, wherein the network comprises a synthetic biological network.

3.   The method of claim 1, wherein at least one of the connections comprises

20   a local connection.

4.   The method of claim 1, wherein the network comprises at least one source node and at least one target node.

25   5.   The method of claim 4, wherein the at least one source node exerts a positive influence on the at least one target node.

6. The method of claim 4, wherein the at least one source node exerts a negative influence on the at least one target node.

7. The method of claim 1, wherein the network comprises at least one randomly generated connection.

8. The method of claim 1, wherein the network comprises all randomly generated connections.

9. The method of claim 1, wherein the network comprises at least one connection representative of one or more connections found in a transcriptional regulatory network of *Escherichia coli*.

10. The method of claim 1, wherein sequentially forcing the output of the node in the network to a value of zero comprises experimental manipulation.

11. The method of claim 1, wherein sequentially forcing the output of the node in the network to a value of zero comprises manipulating a gene.

12. The method of claim 1, wherein each of the nodes in the network comprises at least one outgoing connection.

13. The method of claim 1, wherein the placing step further comprises the steps of:

computing a similarity value; and

comparing the similarity value to a threshold value.

14.   The method of claim 13, wherein the threshold value comprises an optimal threshold value.

15.   The method of claim 13, wherein the threshold value balances true positives with true negatives.

16.   The method of claim 13, wherein the threshold value balances false positives with false negatives.

17.   The method of claim 13, wherein the similarity value comprises a correlation value.

18.   The method of claim 13, wherein the similarity value is less than the threshold value indicating that no connection between the nodes exists.

19.   The method of claim 13, wherein the similarity value comprises a Pearson correlation coefficient.

20.   The method of claim 13, wherein the similarity value is calculated for a plurality of possible pairings of nodes in the network.

21.   The method of claim 13, wherein the similarity value is calculated for a subset of possible pairings of nodes in the network.

22.   The method of claim 1, wherein each of the connections comprises an order corresponding to a minimum number of individual connections needed to traverse from the node to the one or more other nodes.

23. The method of claim 22, wherein the order is used to reduce false correlations.

5   24. The method of claim 23, wherein the false correlations comprise false positive correlations.

25. The method of claim 23, wherein the false correlations comprise false negative correlations.

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26. The method of claim 23, wherein false correlations are reduced using triangle reduction.

27. The method of claim 22, wherein the order is used to reduce false

15 correlations by distinguishing first order connections from all other order connections.

28. An apparatus for reconstructing a synthetic network, the apparatus comprising:

    a memory; and

20   at least one processor operative to:

    determine, on a node-by-node basis, connections existing between nodes in the network by the steps of:

        sequentially forcing an output of a node in the network to a value of zero;

25   computing a similarity measure between the output of the node and an output of one or more other nodes in the network; and

placing one or more putative connections based on the similarity measure.

29. An article of manufacture for reconstructing a synthetic network, comprising:

a computer-readable medium having computer-readable code embodied thereon, the computer-readable code comprising:

a step to determine, on a node-by-node basis, connections existing between nodes in the network by the steps of:

sequentially forcing an output of a node in the network to a value of zero;

computing a similarity measure between the output of the node and an output of one or more other nodes in the network; and

placing one or more putative connections based on the similarity measure.